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THE
LARYNGOSCOPE.

VOL. LVIII APRIL, 1948. No. 4

THE MEMBRANOUS LABYRINTH IN THE CONGENITALLY DEAF COLLIE AND DALMATIAN DOG.*

M. H. LURIE, M.D.,
Boston, Mass.

In the past 15 years a number of observations have been reported on congenitally deaf animals—waltzing guinea pigs,[4] albino cats[1,2] and dalmatian dogs.[3] This is a report of observations made on congenitally deaf collies and dalmatian dogs. The animals studied were from two to four months of age. All animals were deaf and did not respond to external sounds.

In the animals examined there were found no abnormalities of the temporal bone. All changes found were in the membranous labyrinth. The middle ear cavity in several of the animals gave evidence of previous middle ear infection, but the infection had not invaded nor involved the membranous labyrinth.

The scala media of these animals was partially collapsed, and Reissner's membrane was in contact with the structures of the organ of Corti (see Figs. 1 and 2). Occasional strands of connective tissue bound Reissner's membrane to the organ of Corti. The scala vestibuli and scala tympani gave no evidence of being involved in these changes. In contrast to the changes observed in a dog, deaf as a result of a skull fracture, strands of connective tissue from the walls of the scalae ran to Reissner's membrane and the basilar membrane (see Fig. 5). The stria vascularis showed marked atrophy throughout

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the cochlea. The blood supply to stria vascularis was markedly less than normal. The melanin pigmentation was also diminished. The stria vascularis appears as a single layer of cells with few or no capillaries invading this layer (see Figs. 1, 2, 3 and 4).

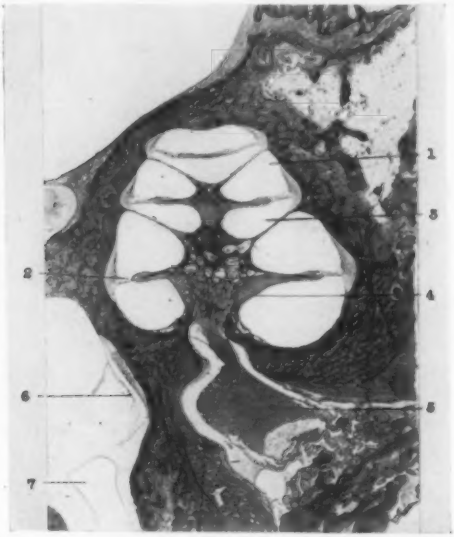

Fig. 1. Cochlea and labyrinth of collie dog showing collapsed scala media and saccule. Utricle normal. (1) Scala vestibuli. (2) Scala media. (3) Scala tympani. (4) Spiral ganglia. (5) Cochlea nerve. (6) Saccule. (7) Utricle.

The tectorial membrane showed interesting changes. In the dalmatian dog it lies under the vestibular lip of lamina ossea spiralis in the internal sulcus (see Fig. 4). It is no longer in its usual position as seen in the normal organ of Corti (see Fig. 6). The tectorial membrane appears swollen and ballooned out, filling the internal sulcus, and has strands of tissue binding it down (see Fig. 4). In the collie dog, the tectorial membrane appears to have been solidified as if made up of a coagulum. In cross-section it has the appearance of a shelf projecting into the scala media (see Figs. 2 and 3). There

are cells lying on top of the tectorial membrane. These cells under high power appear to be remains of degenerated pillar cells and hair cells. This peculiar tectorial membrane is not found throughout the cochlea but is noticed chiefly in the upper half of the second turn. In other parts of the cochlea the appearance is similar to that described in the dalmatian dogs. In the dog, deaf as a result of a fractured skull, the tectorial membrane appears the same as in the dalmatian dogs except that it lies as a rule above and on the vestibular lip of the lamina ossea spiralis (see Fig. 5).

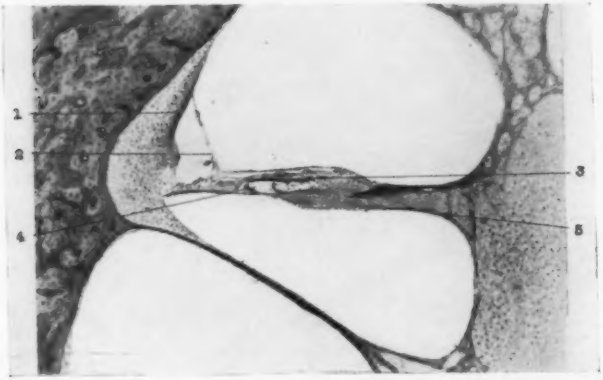

Fig. 2. Second turn. Cochlea, collie. Showing atrophy of stria vascularis. Collapsed Reissner's membrane. The peculiar coagulated appearance of the tectorial membrane. Absence of normal organ of Corti. Cochlea nerve fills canal of Rosenthal and shows no degeneration. (1) Stria vascularis. (2) Reissner's membrane. (3) Tectorial membrane. (4) Organ of Corti. (5) Rosenthal's canal.

The organ of Corti in all of these animals showed marked degenerative changes. No evidence could be found that these changes were due to infection or the phagocytic action of endothelial cells. The most marked changes occur in the pillar cells and the hair cells. The hair cells cannot be identified in the degenerated organ of Corti. The pillar cells can be made out occasionally as in Fig. 4. Dieter's cells and the other supporting cells cannot be identified except from their anatomical relationship to the basilar membrane. The organ of Corti that

appears most changed is in the region where the tectorial membrane has assumed the peculiar structure already described (see Fig. 3). In these regions no structures of a normal type can be made out. A comparison with the normal organ of Corti leaves no doubt that there is no neuroepithelial structure present to respond to sound stimulation (see Fig. 6). On comparing the organ of Corti of the dog deaf from skull fracture with these deaf animals, one sees that the fractured deaf dog still has normal structures present in the organ of Corti, though no hair cells were found (see Fig. 5).

Fig. 3. High power of organ of Corti. Second turn. No normal organ of Corti structure present. The peculiar tectorial membrane. Atrophy of stria vascularis. (1) Stria vascularis. (2) Reissner's membrane. (3) Cells of Claudius. (4) Hensen cells. (5) Coagulated tectorial membrane. (6) Internal sulcus.

The type of degeneration present in the dogs is not the same as found in waltzing guinea pigs. In the waltzing guinea pigs the degeneration of the organ of Corti was such that all structures could be identified except when there was complete absence of the organ of Corti. The tectorial membrane was not involved in the guinea pigs and was usually found in its normal relationship to the basilar membrane.

All the animals showed degeneration of the cochlea nerve. This degeneration was not so marked as one would expect from the degeneration present in the organ of Corti. In all these young animals the canal of Rosenthal showed some atro-

phy of nerve fibres, but there was more atrophy in the cells of the spiral ganglia. There seems to be a definite time lag in the degeneration of the cochlear nerve as compared to that of the organ of Corti. This time lag has also been noticed in the waltzing guinea pig[4] and in experiments on animals subjected to acoustic trauma.[5] The organ of Corti degenerates at a more rapid rate than the nerve. If these animals were allowed to live long enough, there would be found in all probability a complete or marked degeneration of the nerve.

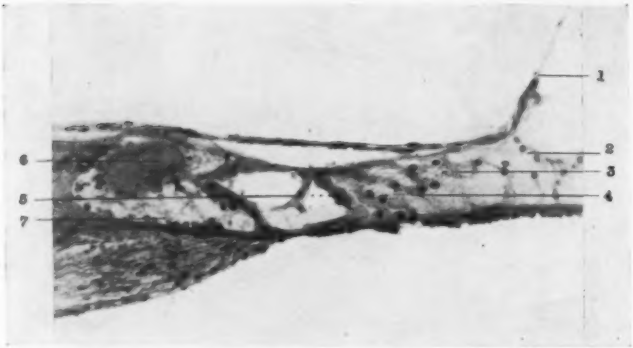

Fig. 4. High power, organ of Corti. Second turn. Reissner's membrane bound down to degenerated organ of Corti. The internal and external pillar cells are present, but in degenerated form. The tectorial membrane fills the internal sulcus and is bound down. Cells of Hensen and Claudius degenerated. (1) Reissner's membrane. (2) Cells of Claudius. (3) Hensen cells. (4) Degenerated external hair cells. (5)Degenerated pillar cells. (6) Tectorial membranes. (1) Internal sulcus.

The vestibular portion showed changes in the saccule. The saccule was completely or partially collapsed (see Fig. 1). Strands of tissue bound the collapsed wall to the macula region of the saccule. At first this was thought to be artifact, but as the utricle and semicircular canals were not collapsed, this conclusion could not be reached. The portion of saccule generally found collapsed was the free wall lying opposite the oval window and not the wall which is in close relationship with the wall of the macula portion of the utricle. The otolithic membrane was not in contact with the macula of the

saccule and appears to lie in a bed of tissue which holds it in contact with the collapsed saccule wall. The macula itself showed degeneration of the neuroepithelial cells in large areas and the saccule nerve showed atrophy (see Fig. 1).

The utricle and semicircular canals were found to be normal. The macula of the utricle and the crista of the semicircular canals were normal. Their nerve supply also appeared to be normal.

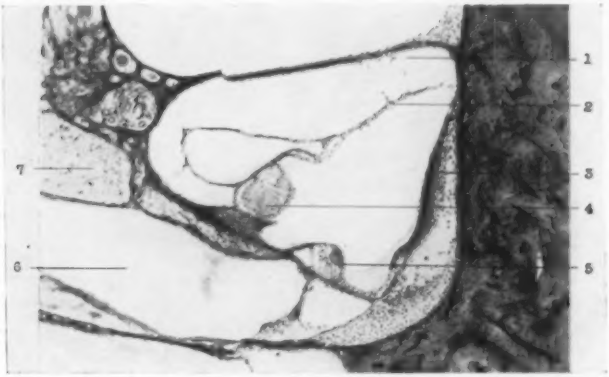

Fig. 5. Second turn. Dog's cochlea. Dog deaf from fractured skull. Degenerated organ of Corti present but normal outline of organ retained. Hair cells absent. Tectorial membrane has similar appearance to the membrane in Fig. 4 but lies on the vestibular lip. Reissner's membrane with adhesions attaching it to bone of scala vestibuli. Adhesion from basilar membrane to bone of scala tympani. Degeneration of cochlea nerve in Rosenthal's canal and spiral ganglia. Stria vascularis atrophied. (1) Scala vestibuli. (2) Reissner's membrane. (3) Stria vascularis. (4) Tectorial membrane. (5) Organ of Corti degenerated. (6) Scala tympani. (7) Degenerated spiral ganglia.

The ductus endolymphaticus and its saccus appeared normal and no obliteration of the duct was found.

The findings in the membranous cochlea were not unexpected as degeneration of the organ of Corti in these animals is what one looks for. The differences found in the waltzing guinea pigs were the normal appearance of the scala media and tectorial membrane. The stria vascularis also showed degeneration, but not so complete as in the dogs. The coagu-

lated appearance of the tectorial membrane in these dogs appears to be a reversion to an otolithic membrane similar to that in the saccule and utricle. These findings are of extreme interest and no explanation for them can be given. The displaced portion of the tectorial membrane is also seen in cats which were congenitally deaf, but why the tectorial membrane does not remain free in the scala media as in the guinea pig is not understood.

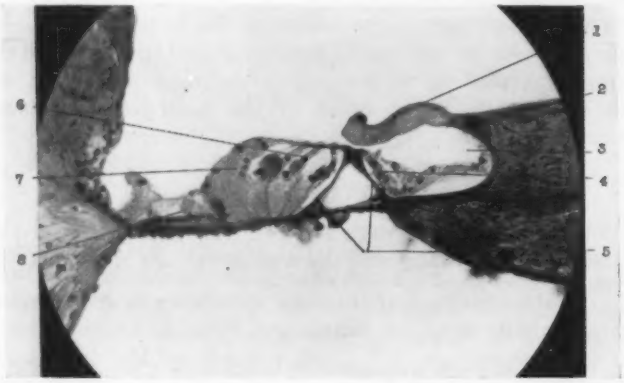

Fig. 6. Organ of Corti. Dog. Normal. (1) Tectorial membrane. (2) Vestibular lip. (3) Internal sulcus. (4) Inner hair cells (5) Pillar cells. (6) External hair cells. (7) Hensen cells. (8) Cells of Claudius.

Of great interest is the question why there is no collapse of the utricle and semicircular canals if the stria vascularis secretes the endolymphatic fluid. The guinea pigs showed no collapse of these structures, but the scala media was also normal in appearance. The saccule in the guinea pig was normal and gave no evidence of the changes as found in these dogs. If the sole source of endolymph is from the stria vascularis, then one of two assumptions can be made in regard to the noncollapse of the utricle and semicircular canals:

1. That enough endolymph was secreted before the degenerative processes started in the cochlea and saccule. The reason for noncollapse of the utricle and semicircular canals

is the support given to their structures by the mesenchymal bands which are numerous and hold these structures in place.

2. That the stria vascularis is not the sole source of the endolymphatic fluid and another structure may function in its place to supply enough endolymph to keep the utricle and semicircular canals in a normal condition. This structure may be the saccus of the ductus endolymphaticus. Only further study and investigation of animals of this type will give the answer to this assumption.

The degeneration of the organ of Corti in these animals gave evidence of the same pattern found in the waltzing guinea pig; that is, normal structures developing first and then degenerating as a result of the inherited gene factor present.

SUMMARY.

Dalmatian and collie dogs with inherited deafness were examined microscopically and these observations were made:

1. No abnormalities of the bone structures in the temporal bone or middle ear were found.

2. Organ of Corti degenerated, scale media collapsed, stria vascularis atrophied. Tectorial membrane displaced, distorted or a coagulum replacing part of it.

3. Atrophy of the cochlea nerve and spiral ganglia not as great as one expected from the degeneration present in the organ of Corti.

4. Partial collapse of the saccule, partial degeneration of its macula, atrophy of the saccular nerve.

5. Utricle, semicircular canals and their neuroepithelial endings were normal. No collapse of these organs was found.

6. The ductus endolymphaticus and its saccus were found to be normal.

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UNIVERSITY OF MINNESOTA COURSE IN OTOLARYNGOLOGY.

The University of Minnesota announces the sixth biennial Continuation Course in Otolaryngology to be held June 28, 29, 30, July 1 and 2. This course is designed to bring to the practicing otolaryngologist the newer concepts and developments in the specialty. The course will be under the direction of Dr. Lawrence Boies and associates of the university medical school. Dr. Harold I. Lillie, Dr. Gordon B. New and others of the graduate school faculty will participate in the instruction. Guest lecturers will include Dr. Kenneth Day, Pittsburgh; Dr. Gordon Hoople, Syracuse; Dr. C. Stewart Nash, Rochester, N. Y., and Dr. Francis LeJeune, New Orleans.

The fee for this course is $35.00. The enrollment is limited. Application should be made at an early date to the Director, Center for Continuation Study, University of Minnesota, Minneapolis 14, Minn.

BRONCHOGRAPHY.*

IRL H. BLAISDELL, M.D.,
Syracuse, N. Y.

Credit for the first bronchography is generally given to Sicard and Forestier[1,35] who, in 1922, instilled iodized oil in the chest for the purpose of delineating the tracheobronchial tree by X-ray. The year 1947 therefore marks the twenty-fifth anniversary of this event and it seems fitting at this time to review the progress that has been made in the field of bronchography in a quarter of a century.

It is the purpose of this paper, not only to record the progress in this special field but also to emphasize how the otolaryngologist can meet present-day demands of thoracic surgery and internal medicine for better studies of the tracheobronchial tree with iodized oil.

Historical Note: Lipiodol was first introduced in France, in 1901, by Lafay. The drug was not used at that time as a contrast medium but was used in the treatment of syphilis. Shortly afterward, Martin wrote an excellent paper on the therapeutic use of lipiodol in respiratory disease. It remained, however, for Rist to show that lipiodol was opaque to the X-ray and these discoveries paved the way for Sicard and Forestier to advocate its use as a contrast medium and to do the first bronchography in 1922.

Early investigators, as Tucker, Jackson and others, tried a variety of compounds. Bismuth subcarbonate and iodized oil was used by Tucker.[2] In 1905, Jackson[32] used bismuth oxide insufflation, but because of its intense irritation, bismuth subcarbonate was used. In 1917, Yankauer applied iodine to bronchiectatic cavities through the bronchoscope. The outline showed on X-ray. In 1917, Waters, Bayne-Jones and Round-

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tree used an emulsion of 10 per cent iodoform and olive oil on dogs with a 25 per cent mortality. There was no clinical application of this method. Weingartner, in 1919, insufflated the lungs of patients with anhydrous thorium oxidate. Lynah and Stewart, in 1920, introduced bismuth subcarbonate and olive oil through the bronchoscope into two lung abscesses and reported five cases in 1921.

General Considerations: Bronchography or lung mapping consists of the introduction of a radiopaque material into the tracheobronchial tree for the purpose of outlining the bronchi on an X-ray film. Poor technique in bronchography leads to films which are of little or no value, or which may be even grossly misleading. The importance of a good bronchogram cannot be over-emphasized.

As a result of the extensive literature concerning pulmonary disease in all its phases, and due to the impetus of thoracic surgery, the internist now turns to the bronchoscopist for consultation much more frequently than was the case 10 or 15 years ago. In other words, internists have become "bronchoscopy conscious."

The importance of the early recognition of disease in any system cannot be over-estimated, for it is obvious that the prompt institution of appropriate methods of treatment stands a much better chance of producing a satisfactory result if the local and general situations are adequately cared for. In dealing with minor ailments, early treatment may only make a considerable difference in the comfort of the patient, but in the case of more serious disease it may mean the difference between life and death. The opportunity to investigate the patient is a necessary preliminary to early diagnosis. In the not too distant past, diagnosis was obliged to wait upon the appearance of symptoms, for otherwise, there was no occasion for the patient to present himself to his doctor. Even then the recognition of early disease was dependent upon the ability of the physician to elicit physical signs, and it is notorious that a physical examination may well be entirely negative until the disease process is moderately advanced. The advent

of bronchoscopy and bronchography have gradually improved the situation as a means of earlier diagnosis of some chest conditions.[12]

The thoracic surgeons themselves have shown the need for better bronchography. Before the thoracic surgeon undertakes to remove a lobe, or a lung, he has every right to expect all the information concerning that patient which it is possible to give him. The thoracic surgeon has every right to complain and to criticize a poor bronchogram on a patient upon whom he wishes to operate. Because of the fact that many otolaryngologists have not perfected their technique of bronchography, Brian Blades once stated, "The bronchoscope was introduced by Killian in 1897. It is lamentable that during the period of more than 40 years, this valuable instrument has not been utilized to its full benefits. One factor which kept the bronchoscope out of general use was its invention and control by otolaryngologists who, in many instances, have little interest in the instrument except for the removal of foreign bodies. Another has been the general impression that the technique of bronchoscopy is difficult to learn."[5]

Not only does the thoracic surgeon wish to know whether or not the patient has pulmonary disease but before contemplating surgery, he must know whether the disease is unilateral or bilateral, whether confined to one lobe, the entire lung or only one segment of a lobe. This information can be furnished him by an adequate and complete bronchogram. Holinger states, "The brilliant advances of thoracic surgery in recent years have presented a challenge to bronchoscopists. Greater accuracy and detail of information, segmental localization of lesions and endoscopic assistance in surgical procedures indicate the trend of endoscopic needs. Of primary importance is the recognition and universal acceptance of the segmental division of the lungs with the corresponding branch bronchi leading to each."[4]

"The bronchopulmonary segment has claimed most attention in recent years, originally because it was recognized to be the seat of lung abscess (Ewart, Kramer, Glass), and more

recently because of the success in resecting segments in bronchiectasis. Notwithstanding the ease with which some segments can be resected surgically, the bronchopulmonary segment should not be considered to be a morphologic bronchovascular unit. It is merely a bronchial distribution with intersegmental planes that may be crossed by arteries from adjacent segments, and that contain veins which drain all contiguous segments."[5]

Indications for Bronchography: The study of the available literature shows that there is a wide diversity of opinion in regard to the indications for bronchography. Lloyd and Perrault[6] believe that a bronchogram is indicated for dilatation of the bronchi, strictures of the bronchi due to extrinsic or intrinsic causes, enlargement of the hilus and bronchial glands, either malignant or inflammatory. Pritchard, Whyte and Gordon[7] have listed the following indications:

1. Cases of cough with purulent sputum with a history of previous pneumonia or organic foreign body.
2. Cases of chronic cough associated with long-standing infection in the upper respiratory tract, particularly sinusitis.
3. Long-standing cough with little, if any, expectoration in the absence of frank pulmonary disease.
4. Bronchiectasis.
5. Bronchial fistula.
6. As a therapeutic agent.

Grier believed that any pneumonia which fails to resolve should be suspected of being bronchiectasis and should have bronchographic studies. He presented a series of 40 patients with bronchiectasis as shown by the instillation of iodized oil; 67.5 per cent were misdiagnosed as primary atypical pneumonia. He believed that bronchography should be done in cases in which pneumonia had failed to resolve in from four to six weeks. Fine and Steinhausen[9] concur in this opinion and have stated: "Since symptoms are slight, patients with

slowly resolving basal pneumonia or peribronchial infiltrations are entitled to bronchographic studies."

"The introduction of the opaque medium accomplishes two purposes:

"*1.* It makes an accurate clinical diagnosis.

"*2.* It provides detailed anatomical facts of the tracheobronchial tree and is a geographic guide to a thoracic surgeon planning operation."[10]

"Patients and physicians alike are learning that chronic, productive cough is a symptom which demands explanation in every instance and that it often cannot be properly ascribed to 'chronic bronchitis' or 'sinusitis' until the actual anatomy of the tracheobronchial tree has been studied by bronchoscopic and bronchographic means."[11]

Patients with bronchiectasis of an upper lobe may seek medical attention because of recurrent pulmonary hemorrhage which cannot be explained by ordinary means of investigation. The diagnosis of bronchiectasis of the upper lobe usually can be made only by bronchoscopic examination with iodized oil. If iodized oil is introduced into the bronchi of a lobe which is atelectatic, an illusion of bronchiectasis may result owing to a foreshortening and apparent widening of the larger bronchi. Their appearance may resemble that of cylindrical bronchiectasis when the lobe re-expands and the bronchi stretch their normal length. The calibre is correspondingly reduced and what simulated bronchiectasis again becomes normal.

Some authors in the past have felt that lung abscess is an indication for bronchography. In general, however, bronchograms in patients with lung abscesses yield no further information than could be gained by bronchoscopy and adequate films of the chest. In obstructive lesions of the tracheobronchial tree, due either to benign or malignant new growths, bronchography is no longer considered essential to the diagnosis since it gives no additional information that could not have been found in other ways. Hinshaw, Corwin and Schmidt[11] have stated that: "In our experience, roentgeno-

graphic studies with iodized oil are of limited value in excluding obstructing lesions of a bronchus, although the site of the obstruction may be demonstrated bronchographically. It is frequently impossible to recognize the obstruction, and incomplete filling of bronchi may simulate organic obstruction in cases in which such obstruction is not present. When an obstructing lesion is suspected, bronchoscopy should always precede bronchography."

Maxwell, however, makes an additional comment: "In the early diagnosis of bronchial tumor, a bronchogram should not be omitted, for it may reveal a filling defect in one of the smaller bronchi and although the diagnosis may be uncertain in such a case, at least it indicates the site of disease and stresses the need for careful observation of the patient.

"In the differentiation of tuberculosis and bronchiectasis, the bronchogram becomes of great importance. In the type of cases which shows hemoptysis as the only symptom, the distinction between bronchiectasis and tuberculosis is of supreme importance. In these cases, a persistently negative sputum is a strong indication for a bronchogram."[12]

Tuberculous bronchiectatics do not always have the marked clubbing of the fingers which may characterize patients with the nonspecific type of the disease. The bronchogram often shows marked distortion of the bronchial tree due to the dilatations of the bronchi.[31]

"The present trends in endoscopy and pulmonary tuberculosis tend to dispel the fears of using iodized oil in suspected or even known cases of acid-fast infection."[13]

In cystic disease of the lung, a bronchogram may be helpful. There is some dispute as to whether congenital bronchiectasis and congenital cystic lung are the same or are different lesions. "From the radiological point of view, the two may be considered the same (Twining, 1938). As a general rule, the larger the cyst the smaller the chance of successful bronchography. Bronchography is thus very important in diagnosing the small multiple cysts, but straight radiography is

superior when it is a question of the larger isolated type of cysts."[14]

In the author's experience, bronchography has been of little value in dealing with patients who are suspected of having neoplastic disease. The bronchogram in these cases gives no additional information that cannot be obtained by good films of the chest without iodized oil. These patients often present a real diagnostic problem and occasionally it becomes necessary to observe the patient over a period of several weeks before the exact nature of the obstruction can be determined. This is particularly so in lesions which lie well toward the periphery of the tracheobronchial tree. If iodized oil has been instilled in such instances, the only positive finding is one of obstruction of a bronchial segment and subsequent interpretation of films is often rendered much more difficult than is the case if bronchography had been omitted. It is the author's opinion, therefore, that bronchography not only is of negligible value in obstructive lesions but oftentimes seriously handicaps the investigator.

The author considers bronchiectasis to be the prime indication for bronchography. This includes suspected cases of the disease, patients with "unresolved pneumonia" and those patients with chronic cough and expectoration. As an additional criterion for bronchography, those patients who are suspected of having bronchiectasis and who are in the age group amenable to surgery should be studied by bronchographic means.

Contraindications: "Studies with iodized oil are contraindicated in the period of acute pneumonitis, since this procedure may produce an exacerbation of the acute process."[8] Lloyd and Perrault[6] have listed as contraindications: fever, hemoptysis and tuberculosis, also patients with diminished oxygen reserve, anemias, emphysemas, asthma and cardiac insufficiencies. Patients sensitive to iodine should not be subjected to bronchography.

The author feels that patients of the older age groups should not be subjected to bronchography, as a general rule. Such

patients generally present a history of cough and sputum for many years. They are not good surgical risks for lobectomy or pneumonectomy, primarily because their disease usually is bilateral and their vital capacity markedly lowered as a result of their long-standing infection. Exact localization of the disease and the determination of its extent in such elderly people is of academic interest only. Bronchoscopy may well be done for the relief of their symptoms temporarily, and other methods of treatment by the internist then carried out; *i.e.*, penicillin aerosol inhalations, climatic changes and the use of iodides.

The Opaque Medium: In the selection of the contrast medium there are three considerations:

1. It must be sufficiently radiopaque.
2. It must have a proper viscosity. If it is too thin, the substance will fill the alveoli before the X-ray pictures can be taken.
3. It must be relatively nontoxic.

Two types of iodized oil are now more or less in general use and have been accepted for bronchography:

1. Iodochlorol (Searle) has a composition of 27 per cent iodine, 7.5 per cent chlorine in organic combination with a highly refined oil.
2. Lipiodol (Lafay) contains 40 per cent iodine.

METHODS OF INTRODUCTION.

1. *In Adults:* Throughout the literature, many methods for the instillation of iodized oil are to be found. The early French workers advocated intercricothyroid puncture, but this was later abandoned because many workers reported serious complications; however, in recent years and probably due to the influence of some of the European bronchoscopists, during World War II, this method is again advocated by some. The area of skin in the midline over the cricothyroid membrane is infiltrated with 1 per cent novocain solution. After the skin

and superficial tissues have been anesthetized, a large gauge needle (No. 14 or No. 16) is inserted with a rotating motion through the cricothyroid membrane. At this point, air should be withdrawn steadily from the trachea into the syringe. Then 2 or 3 cc. of pontocain solution may be instilled directly into the trachea and allowed to flow down into the bronchial tree. The syringe is next removed from the needle and another syringe containing the oil is attached. The oil is then instilled slowly into the trachea.

Various supraglottic methods of instilling iodized oil have been advocated, such as the "aspiration method" of Singer,[30] the similar method of Pritchard and the "passive technique" of Ochsner.[15] After the throat and larynx have been adequately cocainized, the oil may be dropped over the dorsum of the tongue into the larynx. In quiet respiration, some of the oil passes through the anesthetized glottis and fills the tracheobronchial tree. A curved cannula may be utilized and the oil instilled indirectly through the larynx, with the patient's tongue held forward.

The per nasal method of injection of Forestier and Leroux[16] is a modification of that of Hicquet and Hennebert of Brussels. This consists of dropping oil through the nose of the patient, having previously anesthetized the throat and larynx, and with the tongue pulled forcibly forward, the oil is allowed to drop with quiet respiration into the tracheobronchial tree. An intranasal catheter may likewise be used with the tip of the catheter in the oropharynx or extending through the glottis and the oil instilled through the catheter into the trachea. There is also the intubation method of Iglauer[21] and the bronchoscopic method of Clerf,[20] Ballon and Tucker. The bronchoscopic method has the advantage of visualization of the bronchial tree and its aspirations before instilling the oil. The transglottic method utilizes a catheter passed by means of a stylet or a type of curved, semirigid catheter (Stitt) passed through the glottis through the previously anesthetized larynx and trachea.

Adequate premedication of the patient before bronchogra-

phy is carried out is an important consideration. Some one of the barbiturates, as sodium phenobarbital, nembutal or seconal, should be used as a preliminary, in order to counteract any undesirable effects of the cocainization. Usually the barbiturate is given one hour to one and a half hours before the bronchogram is scheduled. Additional medication may be given in some cases, consisting of atropine, or a combination of morphine and atropine in appropriate dosage, 45 minutes to one hour before the instillation of the oil. In many patients with bronchiectasis, atropine is a very desirable adjunct in order to dry up excessive secretions in the mouth and tracheobronchial tree.

In adults, the procedures are carried out, generally, under local anesthesia which assures the operator of some degree of cooperation on the part of the patient. The amount of iodized oil used is dependent upon whether one or both lung fields are to be filled at the same time. Approximately 10 cc. will suffice for one lung and 20 cc. for two lungs. The oil should be of sufficient viscosity so that the alveoli will not be filled before the operator has time to get an X-ray picture.

2. The Technique in Children: The endotracheal method of Forestier and Leroux (1923) using local anesthesia for the skin and cocaine in the trachea was first applied to children by Armand-Delille, in 1924, but was found to be unsatisfactory. "Coughing in children may be overcome by the original supraglottic method in which the patient puts out his tongue, iodized oil is dripped over the back of it (Sicar and Forestier, 1922 and 1932) or by the nasal method (Forestier and Leroux, 1935), in which the tongue is pulled forward and the oil is dripped through the nose; however, the sensitivity of children to cocaine makes these methods hazardous."[17] Field further states that chloroform gives the best picture but is too dangerous for use in children since the child might sit up. She adds that nitrous oxide causes increased respiratory excursions and the oil tends to enter the alveoli. Further, basal narcotics and barbiturates do not abolish the coughing reflex and open ether is best but causes excessive secretion in the bronchi, especially in areas of bronchiectasis. In children,

Field uses a special trocar and nitrous oxide anesthesia until the needle is in the trachea and then no anesthesia, except 2 per cent butethanol (Decicain) in the trachea. She feels that this method is suitable for children over five.

In this country, however, a somewhat different technique is generally followed. Some children can be done satisfactorily under local anesthesia following the same technique as in adults, using 1 or 2 per cent pontocaine with atropine and barbiturates in sufficient amount as preoperative medication. For intractable children, a satisfactory technique consists in using ether anesthesia which is moderately deep. McReynolds advocates the use of morphine and atropine, or scopalamine as premedication. Aspiration of the tracheobronchial tree is first carried out by bronchoscopy. Then the bronchoscope is removed and the catheter is slipped between the vocal cords and the instillation of iodized oil begun.[13]

In the author's experience, small children are best done under ether anesthesia, following in general the technique of McReynolds. There have been no untoward results incident to the use of general anesthesia for this procedure.

Radiological Considerations: Good bronchograms can be secured only with the cooperation of the roentgenologist and the bronchoscopist. Good radiologic technique is of the greatest importance. It goes without saying that all patients should have X-ray studies of the chest before a bronchogram is considered. These preliminary "straight" X-ray films should consist of the usual posteroanterior view and at least a right or left lateral view. An oblique view may also be helpful. These views then serve as a basis for comparison with the series of pictures taken after the instillation of iodized oil. The actual instillation of oil in adults may be carried out under fluoroscope. Direct visualization of the filling is then afforded and over-filling of a segment can be prevented.

In order to secure a successful filling, proper positioning of the patient is of paramount importance. Either the entire right chest or the left may be filled at one sitting and in cooperative patients a complete five-lobe filling may be done

at the same time. With the patient in the erect position (sitting or standing), the patient is tilted slightly to the right side. The oil should then pass directly to the right lower lobe. By having the patient bend slightly backwards and to the right, posterior segmental branches of the lower lobe can be filled. The right middle lobe filling is accomplished by having the patient turn slightly to the right but well forward. The amount of iodized oil required for the filling of the right lower and middle lobes is approximately 10 cc. The patient is now placed on a tilt table with the head lowered approximately 20 degrees from the horizontal and lying on the right side, the right upper lobe can be filled by allowing the oil in the lower lobes to gravitate downward into the dependent upper lobe. Occasionally, 2 or 3 cc. of oil may have to be injected in addition to secure a complete filling.

The left side is filled in approximately the same way. With the patient in the erect position, the lower lobe is filled by having the patient lean toward the left side. The patient should then lean slightly forward to the left in order that the lingula may be filled adequately. Following this, the patient is again placed on the tilt table on his left side, with the head lowered so that filling of the left upper lobe may take place. It is important that both the middle lobe on the right and the lingula on the left be filled adequately to demonstrate all bronchial subdivisions because 60 per cent of cases of lower lobe bronchiectasis have involvement of the middle lobe or lingula in addition.

The X-ray exposures are now made, either with the patient again in the erect position or lying flat on the X-ray table. Some roentgenologists recommend that four exposures be made — a dorsoventral, a right anterior oblique, a left anterior oblique and a right or left lateral view.[18]

"Lateral films are important to outline bronchial dilatations which may be obscured by the cardiac shadow in the postero-anterior view."[19]

The oil should never be forced into the bronchus under pressure since alveolar spread may completely obscure the picture.

"Improper techniques may be responsible for errors, not only in the diagnosis of disease but in the highly important determination of the exact extent of the lesion."[22]

After satisfactory Roentgenograms have been taken, it is advisable to have the patient attempt to cough and expectorate as much of the oil as possible. If the patient has coughed during the procedure, some of the oil may be found in the finer bronchi and alveoli. If the oil has been forced into the bronchi, a large amount will be found remaining *in situ* in the alveoli. Some of this will be gradually absorbed and some is taken to the lymph nodes by phagocytes. "The iodine is excreted in urine, saliva and sweat. X-ray studies show that there is retention of iodized oil in the lungs from 24 hours to two years."[23]

The physician undertaking to do a bronchogram, therefore, has a twofold responsibility. His bronchograms must be of excellent quality; first, to make a comprehensive diagnosis and to give the surgeon the maximum of information concerning the patient. Second, the bronchograms must be of good quality so that there will not be large amounts of iodized oil remaining throughout the chest to obscure findings and to hamper the interpretation of future Roentgenograms by other physicians.

Reactions: In bronchography, two types of reactions may be encountered. The first is the reaction to cocaine or pontocaine and the direct result of the substance used for local anesthesia. Proper premedication of the patients with barbiturates should minimize these reactions. The symptoms of cocaine or pontocaine reaction are well known to all otolaryngologists and need little emphasis here. The sweating, apprehension and nervousness of the patient, together with a thin, rapid pulse and signs of syncope and circulatory collapse, are indications for the institution of some form of barbiturates as an antidote. Although these reactions have been few in our own clinic, they have occasionally occurred. For this reason, a sterile solution of sodium phenobarbital is kept on hand at all times for these emergencies.

The second reaction is perhaps not as frequently encountered, nor is it as well understood. This reaction is the direct result of the absorption of iodine in the sensitive patient. Mahon[24] has covered this aspect of the field most adequately in a recent paper. "Severe or fatal reactions are relatively rare following the instillation of iodized oil into the tracheobronchial tree. At the Mayo Clinic, it was estimated that about 300 bronchograms, representing some 200 individual patients, are performed yearly. Patients are not tested for iodine sensitivity prior to lipiodol bronchography unless they give a history of sensitivity to iodine. Among these patients who are senstive to iodine, about six mild reactions occur each year. All have been controlled without fatality."

In a search of the literature, White and Bayliss[25] could find only eight cases of severe reaction (of which three were fatal) reported in the literature up to 1923. They added one nonfatal case of their own.

Mahon[24] reports that the types of reaction that may occur following the use of iodized oil have not been found classified in the available literature; however, the Mayo Clinic has classified them as follows:

"*1.* Swelling of the parotid and submaxillary glands beginning shortly after the instillation of the oil and subsiding within 24 to 48 hours. This is the most common reaction, is seen three or four times a year and occurs in patients without allergic history.

"*2.* Asthma occurring about once a year, always in persons who show other signs of allergy.

"*3.* Urticaria beginning almost immediately, not occurring over once a year and probably on an allergic basis.

"*4.* Skin eruptions, papula or pustular occurring 10 to 14 days after the instillation of the oil, similar to a drug eruption and not seeming to have an allergic basis."

Scadding reported that he had had frequent mild reactions and two severe ones following lipiodol bronchography. Mild reactions were mainly a transient coryza and mild urticarial or erythematous rashes of the urticarial or acute irritant type,

occurring some seven to 10 days after the use of iodized oil. He further stated that headaches occurred rarely.

Throughout the literature, reactions ascribed primarily to lipiodol have been classified under the heading of "acute iodism." These reactions have been, for the most part, skin lesions of a type described as hemorrhagic bullous urticaria.[27]

The other reactions reported from the literature represent either pulmonary reaction or are not described with sufficient accuracy to determine the exact type of reaction involved. Some of these cases are reported incidental to other subjects, such as various studies of asthma, diagnostic or pathologic, or studies of the use of iodized oil as a therapeutic agent. Mahon[24] reports a fatal case with convulsions beginning 75 minutes after lipiodol and due to asphyxia as a result of plugging of the bronchial tree by thick mucus.

Conclusions: Since the first bronchogram was performed, in 1922, considerable progress in this particular field of endeavor has been made. The indications for bronchography have become more clearly defined than they were 25 years ago. Due to the excellent work in the field of thoracic surgery, bronchiectasis is not an incurable disease if the diagnosis is made early enough so that adequate surgical measures can be carried out. The use of iodized oil for accurate localization of the diseased area in bronchiectasis and of accurately determining the extent of the disease has become one of the prime indications for bronchography. In elderly patients with advanced pulmonary pathology, where the chance of cure by surgery is entirely out of the question, a bronchogram is not indicated since it serves an academic purpose only. Now that branchoscopy and bronchography are being carried out by thoracic surgeons and internists, as well as otolaryngologists, it seems important that the otolaryngologist realize that good bronchograms are to the thoracic surgeon and internist as good blueprints are to a construction engineer.

If the otolaryngologist is to continue to do bronchoscopy and bronchography, he must, of necessity, be able to turn out consistently bronchograms which will give all the information

which his colleagues in thoracic surgery and internal medicine may require. Unless he can do this, all of the bronchoscopic and bronchographic work will be in the hands of men primarily interested in chest disease and the otolaryngologist will be limited to an occasional foreign body.

Dr. Lyman Richards,[28] of Boston, once wrote a paper entitled, "Endoscopy at the Crossroads," in which these warning notes were sounded. He might well have included bronchography, for this field is at the crossroads now.

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TREATMENT OF ENDONASAL AND CUTANEOUS LUPUS VULGARIS WITH CALCIFEROL. WITH REPORT OF A SUCCESSFUL CASE.*

ROBERT E. PRIEST, M.D.,
Minneapolis, Minn.

This paper discusses the treatment of nasal tuberculosis (lupus vulgaris) with calciferol (vitamin D_2) and summarizes a case successfully treated.

REPORT OF CASE.

Mrs. R. H. L., a white woman, 60 years of age, was first treated by the author on June 5, 1942. She had noted obstruction of her left nostril for the preceding two months and left epiphora had been present for the same length of time. There had been no abnormal nasal drainage and no pain. The patient had breathed well through her left nostril until it became obstructed. The nostril bled only if she massaged it vigorously with a handkerchief.

Examination showed a moderate septal deflection to the left. The anterior portion of the septum was covered with rough, dark red, granular tissue about 1.5 mm. thick. The nasal airway was almost completely obstructed and rough tissue on the lateral nasal wall seemed to be of the same character as that on the septum (see Fig. 1). The septal lesion was biopsied on June 6, 1942. Bleeding was not profuse. The biopsy was performed as an office procedure. The nostril was packed and the patient had only minor discomfort as a result of the biopsy. The biopsy showed the nasal lesion to be tuberculosis (see Fig. 2).† A chest Roentgenogram was normal and general physical examination showed no pulmonary tuberculosis. Blood serology was not indicative of lues. On re-examination the patient was found to have a small bluish lesion about 2 mm. in diameter on the left cheek. This was biopsied and proved to be tuberculosis (see Fig. 3). Complete examination of the patient's family, including the grandchildren who lived in her house, showed no tuberculosis except as indicated by positive tuberculin tests.

The patient was examined again by the author on June 10, 1946. She stated that she had been well since her last examination in 1942 and that she had consulted no physician in the interim. Nasal obstruction had increased slightly and there was now a nodule about 3 mm. in diameter on the upper lip just below the left naris. Treatment with high doses of vitamin D_2 (calciferol) in accordance with reports of several French inves-

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†Histological diagnosis made by Dr. E. T. Bell, Professor of Pathology, University of Minnesota, Minneapolis, Minn.

‡Material supplied by the Winthrop Co.

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tigators was decided upon and a special preparation of this material was ordered.‡

Chest and sinus films were made on June 13, 1946, and showed no abnormality. Before the vitamin D_2 preparation could be obtained the patient developed an abscess involving her left upper canine and first molar teeth. The author was apprehensive for fear that the abscess was tuberculous in origin, but the teeth were extracted, the abscess was drained, and the gums healed promptly.

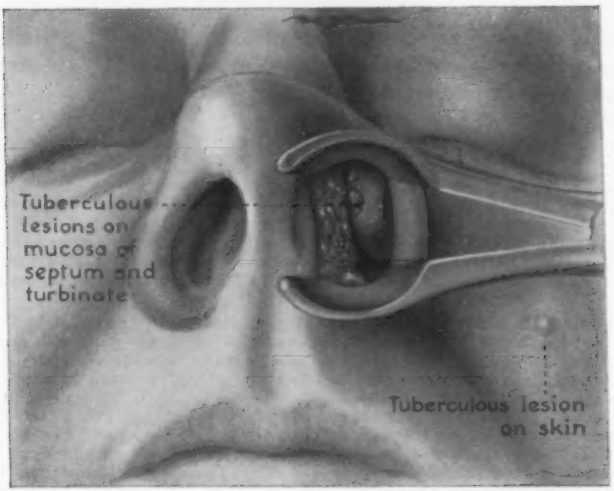

Fig. 1. Drawing showing nasal and cutaneous tuberculous lesions of patient described in case report.

On Aug. 7, 1946, the patient began to take highly concentrated vitamin D_2 in propylene glycol (Drisdol) by mouth. The preparation contained 50,000 international units of vitamin D_2 per cc. The patient took 4 cc. (200,000 units) in a glass of milk three times during the first week and twice during the second and third weeks; then she continued the same dose once per week for 16 weeks. At the time treatment was started the lesion looked almost exactly like it had in 1942 when it was first seen (see Fig. 1).

On Sept. 11, 1946, the patient said that she could not notice much difference in her nose, although at times the nasal airway seemed slightly more open. It seemed to the examiner that the lesion was smaller. On Oct. 21, 1946, there was very marked improvement in the nose. The tuberculous mass had receded until the airway was almost normal in size. The lesion occupied an area about 1 mm. in diameter near the lower edge of the nasal septum. By Nov. 15, 1946, the patient's nasal tuberculosis seemed to be entirely healed. The lesion at the lower margin of her left naris could scarcely be found and the patient's airway was normal.

The patient was seen again on March 18, 1947. At this time she had a recurrence of her nasal lupus. The lesion looked almost as large as it had on the first examination. She was given calciferol again in the same dosage as before and by May 3, 1947, had improved markedly. She then developed virus pneumonia which gave concern because of the possibility that it was actually pulmonary tuberculosis; however, the lesion gradually receded and guinea pig innoculations made from both sputum and gastric washings were negative. At this time the patient's blood picture was normal. Urea nitrogen was 11.2 mg. per cent with a phenolsulfonphthaline test of 34 per cent. Blood cholesterol was 174 mg. Blood calcium was not measured. An electrocardiogram was normal.

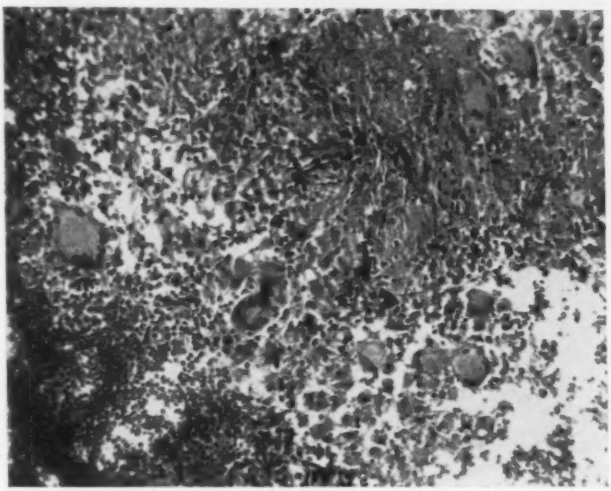

Fig. 2A.

The patient was re-examined Sept. 20, 1947. The nose showed no abnormality except for slight crusting in the area formerly occupied by the tuberculous lesion. The patient feels perfectly well and is satisfied that she is cured of her nasal tuberculosis. It is entirely possible that she may not maintain her present improvement.

What is lupus vulgaris? Michelson and Laymon[1] classify lupus vulgaris as a form of cutaneous tuberculosis which is chronic and progressive but is rarely fatal. Lupus vulgaris begins insidiously with one or a few lesions in one locality. The patient can hardly state when the disease began. Michelson and Laymon state that in lupus vulgaris "a high degree

of immunity is found but the resistance is not great enough to overcome the disease, and lupus vulgaris therefore persists for years; nevertheless, death from pulmonary tuberculosis in patients with lupus is not a rare occurrence, and there seems to be a relation between the cure of the external lupus and the unsatisfactory progress of the internal lesions — so much

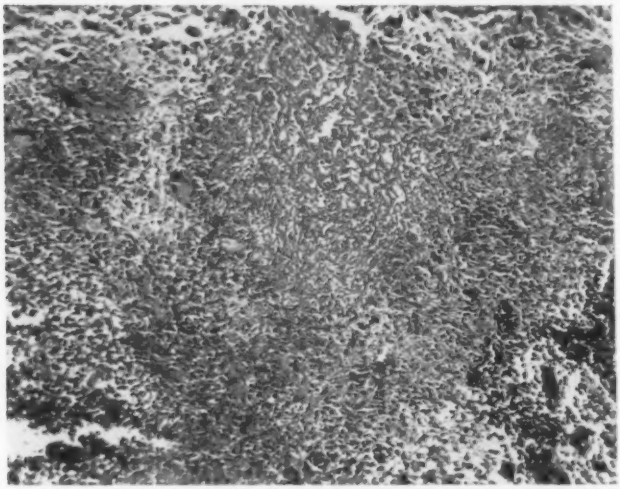

Fig. 2B.

Fig. 2. Photomicrographs of sections from nasal lesion showing tuberculosis.

so that it is impossible to think of lupus vulgaris as being merely an external disease." In the case reported here no lesion aside from the endonasal and cutaneous ones was found.

According to Thomson and Negus,[2] lupus usually attacks the cartilaginous septum (see Fig. 1) as well as the nasal floor and anterior portion of inferior turbinate. It may spread up the lacrimal duct to the inner canthus of the eye and can cause corneal ulceration. The disease is painless in the nose. The disease may heal in one area and spread in another. Old treatments included chemical and galvanocautery and radium

application. Pathologically, lupus vulgaris consists of typical noncaseating tubercles of the corium (see Fig. 3).

Cases similar to the one described here are reported by Fletcher,[3] Aliaga and Stutz,[4] Specht,[5] Ide,[6] Richter,[7] Theissing,[8] Tavani,[9] Brown-Kelly,[10] and Sciuto and the Castiglioni,[11] and are summarized in the literary reviews of Wilson and Stern.[12,13]

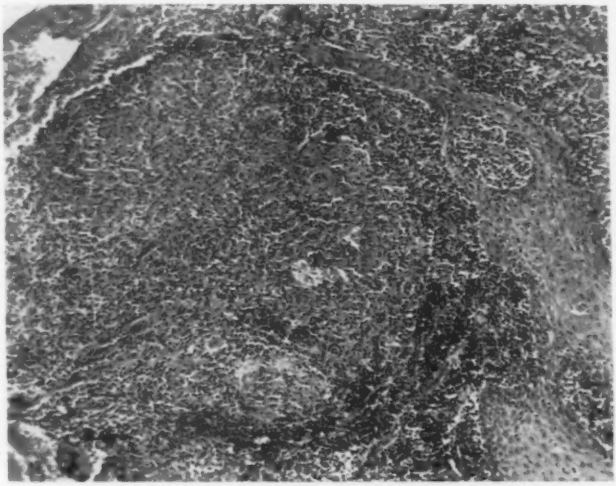

Fig. 3A.

Some Historical Information on Vitamin D in Tuberculosis:

In 1848, Emery[14] noted improvement in 74 patients with lupus vulgaris treated by daily administration of as much as one liter of cod liver oil. Because of the unpalatability of such large amounts of cod liver oil the method was impractical. Cod liver oil is now known to contain about 85 international units of vitamin D per gram. In 1925, Malmstrom[15] irradiated cod liver oil after noting the work of Henri and Baroni.[16] These investigators had found that the tubercle bacillus loses its acid fastness after a few minutes' radiation with a quartz

lamp. Malmstrom believed this indicated that the fat in the capsule of the tubercle bacillus was changed by the quartz lamp radiations. Irradiated cod liver oil was given to the tuberculous patients by mouth and subcutaneously by Malmstrom. It was also applied locally. He states that "in certain cases the healing of tuberculous foci has undoubtedly been accelerated by local treatment with this preparation in various forms."

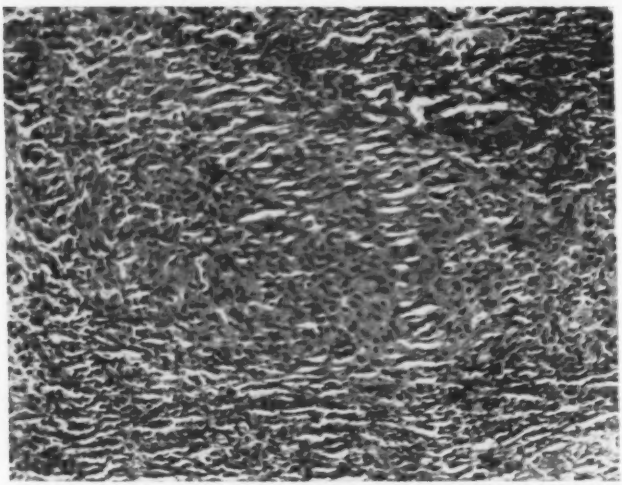

Fig. 3B.

Fig. 3. Photomicrograph of cutaneous lesion from left cheek showing tuberculosis, from same case as Fig. 2.

Grant, Suyenaga and Stegeman[17] worked with white rats ordinarily immune to tuberculosis. By decreasing calcium and vitamin D in their diet, the rats were rendered susceptible to tuberculous infection. Rats receiving adequate diets before and after innoculation with the tubercle bacillus were immune to four to 10 times the doses which caused tuberculosis in the artificially susceptible animals.

Calciferol in Lupus Vulgaris: In 1942, Fanielle[18] reported

favorable results in four cases of lupus vulgaris treated with irradiated ergosterol. After 12 years of observation, Fanielle believed that irradiated ergosterol in treatment of human tuberculosis was of distinct value.

In 1943, Charpy[19] began to report cures of lupus vulgaris treated with calciferol. Of 39 cases reported as cured by 1946, 12 had been treated by administration of vitamin D_2 only and the other 27 by vitamin D_2 plus local destructive therapy such as coagulation with diathermy. Improvement did not continue after four or five months of treatment, and local destructive measures were applied if the cure was not complete by that time.

The Charpy method consists of oral administration of 600,000 units of vitamin D_2 as follows: three doses during the first week, two doses weekly for the next three weeks and one dose weekly for the next four months. Charpy considers a high calcium intake a necessary adjunct to calciferol therapy. His patients received one to two liters of milk daily or 0.5 gm of calcium gluconate daily for 20 days of each month.

Dowling and Prosser Thomas,[20] in England, began treating lupus vulgaris with calciferol in 1943. In 1945, they had records of 38 lupus patients either being treated or being followed up after stopping treatment. Twenty-seven showed favorable responses. Of the 11 showing no improvement, in some the lupus had burned itself out, and in others marked scarring and radiodermatitis made evaluation of progress inaccurate.

Macrae[21] reported cures in 14 of 20 cases of lupus vulgaris whose average duration before treatment was 19 years. Macrae noted that during the first two or three weeks of treatment "the patches became angrier and isolated nodules more scarlet, with an increased tuberculin reaction and sedimentation rate." A steady improvement usually followed this reaction. Dowling and Prosser Thomas[20] varied their dosage according to the patient. The maximum daily dose was 150,000 units; this was reduced to 100,000 units after varying

periods and further reduction to 50,000 units was sometimes made.

In a series of patients treated at the University of Minnesota Hospital by Haserick and Michelson,[22] a combination of the French and English methods was employed. At first viosterol in oil in a dosage of 150,000 units daily was employed. An adequate intake of calcium was assured by having the patients drink at least one quart of milk daily. Later, the authors changed to a solution of vitamin D_2 in propylene glycol which was especially prepared in a form containing 50,000 units of vitamin D_2 per cc. As propylene glycol is water soluble and is more readily miscible with the gastric contents, it was thought that better results might be obtained with this vehicle. With this preparation, between 1,000 and 2,000 units of vitamin D were administered per kilogram of body weight per day. One thousand units per kilogram were given to bedridden patients and an attempt was made not to give massive doses of vitamin D_2 to any patient having arteriosclerosis, nephritis or any form of urinary stasis.

Toxicity of Calciferol: According to Dowling and Prosser Thomas,[20] calciferol (vitamin D_2) is a potentially toxic drug. It is a purely artificial substance, said to be almost always contaminated with other possibly toxic by-products of irradiation. It is produced by exposing the *vegetable* sterol, ergosterol to ultraviolet light, and is thought to be more toxic than the naturally occurring vitamin D_3 formed by action of ultraviolet light on *animal* sterols and found in animal products such as egg yolk, butter and fish liver oils.

Toxic reactions to calciferol have been observed and reported. General well-being and a good appetite may be the first sign of poisoning. Anorexia, nausea, vomiting and polyuria follow. Metastatic calcification of renal tubules, arterioles and the media of large vessels may occure due to the mobilization of calcium and phosphorus.

Bicknell and Prescott[23] are quoted by Dowling and Prosser Thomas as authorities for the statement that most patients tolerate calciferol in doses of from 200,000 to 400,000 inter-

national units daily. From a clinical point of view, they believe: *1.* that if large doses must be given, it is useless to rely entirely on blood calcium determinations as a safeguard (the clinical course and renal function tests are most important); *2.* that the giving of highly concentrated vitamin D and calcium preparations together is unwise; *3.* that fish liver oils should be the source of high doses of vitamin D; *4.* that in patients with nephritis or cardiovascular disease large doses are unwise.

Covey and Whitlock,[24] in 1946, reviewed the subject of vitamin D intoxication and concluded: *1.* that vitamin D in massive doses is a toxic substance which produces parenchymal injury especially in the kidney; *2.* that in doses greater than 150,000 units per day it is a dangerous drug; *3.* that in individuals who have evidence of renal disease it should not be used; *4.* that in hypertensive, arteriosclerotic or psychically disturbed persons its safe use is open to question; *5.* that its use should be closely supervised and it should be discontinued if toxic signs occur (nausea, vomiting, headache, albuminuria, granular casts, elevation of blood urea, and depression of output of phenolsulfonphthalein); *6.* that kidney damage may be irreversible.

Haserick and Michelson[22] say that reactions to vitamin D_2 in the treatment of cutaneous tuberculosis fall into two groups. The first is the local flare-up likened to the Herxheimer reactions of syphilis seen at the site of the disease. The second group is more purely a vitamin D_2 intoxication of the type discussed above.

Mode of Action of Calciferol on Tuberculosis: Steenken and Baldwin[25] found that crystalline vitamin D when added to certain media on which virulent tubercle were grown did not change either the growth characteristics or the virulence of the particular strain or organism tested. They quote evidence that feeding irradiated cream or oil concentrates moderately high in vitamin D to tuberculous guinea pigs produced no change in the disease. Presumably the "tuberculous guinea pigs" had parenchymal disease and not cutaneous disease only.

The opposite view point was expressed by Raab,[26] who concluded that "vitamin D, activated ergosterol is bactericidal to tubercle bacilli, . . . *in vivo* and *in vitro*." The local reaction sometimes observed in the tuberculous lesions of patients being treated with vitamin D_2 is mentioned by Haserick and Michelson[22] as possible evidence of direct action of calciferol on the tubercle bacillus.

Distribution of vitamin D_2 in the body would seem to be important if its effect were to be noted in the various organs infected by the tubercle bacillus. In 1939, Vollmer[27] administered 1,000,000 units of vitamin D in three and a half days to a dying infant. After death the various organs were bioassayed for the presence of vitamin D. Vollmer found that the major portion was stored in the brain, liver and skin. No appreciable amounts were found in the lungs, spleen or bones.

SUMMARY.

A case of lupus vulgaris of the nose proven by biopsy and observed over a five-year period to remain unchanged was then treated with massive doses of vitamin D_2 (calciferol in propylene glycol). Improvement was apparent in about two months. After one exacerbation the patient made steady improvement and 13 months after the start of her treatment was found to be completely healed.

Lupus vulgaris is a chronic form of tuberculosis of the skin and mucous membranes which is almost a perfect balance between the virulence of the organism and the resistance of the host; therefore, cases go on for many years without healing or progressing to any great extent. The case reported here was observed for five years prior to treatment and had scarcely changed at all during that time.

The use of vitamin D in the treatment of lupus vulgaris is nearly 100 years old, since cod liver oil was reported to produce improvement in 1848.

The use of very large doses of vitamin D_2 (calciferol) in treatment of lupus vulgaris was reported in 1943 by Charpy, in France, and by Dowling and Prosser Thomas, in England.

Their method consists essentially of giving from 150,000 to 600,000 international units of calciferol several times weekly at first, and later once weekly. The calciferol is supplemented by one or two liters of milk per day or by calcium gluconate.

Not all cases of lupus vulgaris remain well after receiving calciferol. The therapy appears to be worth trying in all cases, however. Local destructive procedures are necessary in many cases, according to the literature but were not used in the case reported here.

Toxic reactions to large doses of vitamin D are reported. Some believe them due to chemical substances formed during the preparation of vitamin D_2, and not adequately removed prior to clinical administration of the drug. Others feel that calcification of renal tubules and arterioles is the most important factor in production of reactions.

Whether calciferol acts directly on the tubercle bacillus or on the tissues in which the organism exists is not settled. The severe local tissue responses sometimes seen after initiation of therapy is pointed out as evidence of direct action on the organism. Blood calcium levels do not parallel clinical response.

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302 Medical Arts Building.

THE USE OF ROENTGEN RAYS IN SMALL DOSAGES FOR THE RELIEF OF PAIN IN INFLAMMATIONS OF THE EXTERNAL EAR.*

J. W. McLAURIN, M.D.,
Baton Rouge, La.

Otitis externa, furunculosis and similar affections of the external ear, although they are apparently trivial conditions, account for an entirely disproportionate amount of trouble. They cause a great deal of annoyance, inconvenience and sometimes actual disability to the patient, and they provide many difficulties for the otolaryngologist who encounters them in his practice. It is almost a cliché to remark that the variety of therapeutic regimens suggested for their management indicates that no single form of treatment is satisfactory, but it is literally true. McBurney and Searcy,[1] for instance, noted that 60 different chemicals had been used in the treatment of otitis externa of fungous origin, and they themselves tested 69 substances and combinations of substances for this purpose. Myringotomy is not infrequently performed in the mistaken belief that the reddened, inflamed appearance of the tympanic membranes evident when the superficial debris is cleared away is the result of a deeper-seated process.

The incidence of these infections varies widely. They are particularly common in the South and in damp and moist tropical areas. They were a prolific source of disability and wasted manpower in the Pacific Ocean Theaters of Operations during World War II. They are often resistant to treatment, and recurrences are frequent. Infections of such a degree as to cause progressive pathologic changes involving the middle ear are not common but may occur, and permanent impairment of hearing is an occasional outcome. In the majority of cases of otitis externa and similar conditions the administration of

*From the Division of Otolaryngology of the School of Medicine of Louisiana State University.

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TABLE 1. SUMMARIZED DATA IN VARIOUS DISEASES OF THE EAR TREATED SUPPLEMENTALLY BY ROENTGEN RAY THERAPY.*

Disease	Otitis Externa (Bacterial)	Otitis Externa (Fungous)	Furunculosis	Otitis Media
Number cases	41	18	94	28
Age range	4 months-60 years	5-45 years	3-71 years	1-63 years
Type case				
Acute	28	7	66	15
Chronic	13	11	28	13
Duration				
Acute	1-21 days	2-14 days	1-21 days	1-14 days
Chronic	22 days-13 years	15 days-2 years	22 days-? years	15 days-? years
Average treatments				
Acute	1-2	1-2	1	1
Chronic	3-4	2-3	2-3	2-3
Average dose (in r.)				
Acute	150	127	78	115
Chronic	350	197	248	205
Relief of pain				
Acute	26 (93%)	7 (100%)	65 (98%)	14 (93%)
Chronic	10 (77%)	10 (91%)	26 (93%)	13 (100%)

*Exclusive of one case of perforation of the tympanic membrane with excoriation of the canal, seen in the acute phase. Pain was relieved by a single application of 62 r.

any form of therapy which requires local manipulations — as most forms of therapy do — may be considerably handicapped by the discomfort and actual pain common in these diseases. In my own experience, over the last four years, this particular problem has been practically solved by the use of Roentgen ray therapy in small doses as an adjunct measure to control pain. At first it was used more or less tentatively. Later, as the good results became evident, practically all patients with inflammatory conditions of the external ear and a few with otitis media (see Table 1) were treated by this measure in combination with routine measures applicable to the special condition present.

The purpose of this communication is to call attention to the palliative value of Roentgen ray therapy in inflammatory conditions of the ear.

RATIONALE OF ROENTGEN RAY THERAPY.

The use of Roentgen ray therapy in various types of infection has been common practice among radiologists since shortly after Roentgen's discovery.[2] Among the remainder of the profession, however, this measure is still looked upon with some degree of doubt. One reason may be that the roentgenologists themselves are not in full agreement as to the mode of action of the rays.

According to Pendergrass and Hodes,[3] the chief effect is vascular, though Roentgen rays also affect bacteria and influence the normal cellular response to tissue irritants and the normal immunologic responses. Desjardins,[2] on the other hand, takes the position that irradiation is unlikely to affect bacteria in the doses used for the treatment of inflammations; certain bacteria can be destroyed by Roentgen rays, but they respond only to doses far larger than those usually used on human subjects. In Desjardins' opinion the chief changes following Roentgen ray therapy are cellular because *1.* a local increase in leucocytes is the most prominent pathologic change in inflammatory processes; *2.* of all cells, leucocytes are most readily affected by Roentgen rays; and *3.* of all types of

leucocytes, lymphocytes, which predominate in inflammatory processes, are most sensitive to these rays. The action of Roentgen rays in inflammations, according to Desjardins, is fivefold: *1.* destruction of leucocytes (lymphocytes); *2.* transient increase in polymorphonuclear cells; *3.* dissemination of destroyed leucocytes, including the bacteriolytic substances which they contain, between the remaining intact cells and in the tissue fluids of the inflamed area; *4.* increased phagocytosis, which is an indirect effect; and *5.* increased local circulation.

Exactly why irradiation relieves the pain associated with inflammation is not clear. Pendergrass and Hodes[3] explain it as the result either of destruction of leucocytes or of protein and lipoid changes in the region of nerve endings. In their opinion relief is associated with rapid elimination of toxins and with disappearance of edema attending an artificially induced hyperemic state. This explanation is in line with the theory advanced by these observers that the chief effect of Roentgen rays in inflammatory processes is vascular.

If the infection is of fungous origin, Gill's[4] theory is perhaps acceptable, that the Roentgen rays have a restraining influence on sporulation, which in turn influences the life cycle of most of the fungi responsible for this type of infection.

REPORTED CASES.

The most extensive report on the effect of irradiation in otitis externa is by Friedman and Hinkel,[5] who used this method in 100 cases, 82 of which had proved refractory to the usual medical measures. Their total dosages were much larger than those employed in the series to be reported in this communication, since their intention was therapeutic and not merely the relief of pain. Single doses varied from 30 r. in acute cases to 100 r. in chronic cases, and in some instances the total dosage reached 1,000 r. Patients with acute inflammations were treated every two or three days. Patients with chronic infections received 70 to 100 r. every week for a

month. Whether or not treatment was continued after this time depended upon the status of the case.

Friedman and Hinkel's experiences in the relief of pain by the use of Roentgen ray therapy are relevant to this discussion. Of 27 patients with acute infection, six had some exacerbation of symptoms within the first 12 hours after treatment but thereafter had complete relief. The majority of the remaining patients had relief within 12 hours, and sometimes within three or four hours. Prompt relief of the discomfort caused by the swollen external canal without painful tamponade was, in the opinion of the writers, one of the great advantages of the method. They emphasized the fact that subjective relief occurred with little objective change.

ANALYSIS OF DATA.

The 182 cases which make up my personal experience with Roentgen ray therapy used in inflammations of the ear for the relief of pain (see Table 1) comprise 59 cases of otitis externa, 41 of which were of bacterial, and 18 of which were of fungous, origin; 94 cases of furunculosis of the external ear; 28 cases of otitis media; and one case of perforation of the tympanic membrane with excoriation of the canal. In 171 of the 182 cases sufficient relief (though it was not always complete) was secured within 24 hours to make it possible to proceed with any desired manipulations, with the full cooperation of the patients, who particularly appreciated the fact that they could continue their usual activities while under treatment. Occasionally, as Friedman and Hinkel noted in their cases, there was an exacerbation of symptoms for a period of 1 to 12 hours after Roentgen rays had been applied, but in other cases relief occurred within three or four hours. The prompt relief of pain achieved by this method was particularly advantageous in young children, in whom, incidentally, the dosage seldom exceeded 75 r.

It should be emphasized that Roentgen ray therapy was used in this series of cases entirely for the relief of pain. The total dosages were too small to be therapeutic. In numerous

cases, on the other hand, some therapeutic effect was apparent. Since no control series of cases was run, it is impossible to speak definitely on this point, but the clinical evidence was extremely suggestive. The duration of treatment frequently seemed shorter than in similar cases treated exclusively by other measures, and the number of medical treatments necessary to bring about disappearance of the inflammation averaged only three. Numerous acute cases cleared up under a single medical treatment and in not more than half a dozen cases in the whole series were as many as 10 treatments necessary.

It can be said with reasonable confidence, moreover, that recurrences have been few. There has been no formal follow-up in these cases, it is true, but more than 75 per cent of the patients in the series represent the so-called family type of practice; I have seen the patients themselves for other oto-laryngologic conditions; or I have seen other members of the family, and I can be reasonably certain that in most of these cases, if the results of therapy had not been satisfactory, the patients would have returned to me or I would have heard elsewhere of the poor results.

The management of a patient with symptoms referable to the external ear follows a definite routine in my office. It begins with a careful history. Questions are particularly directed toward *1.* possible previous episodes of the same or a similar condition; *2.* the duration of the present episode; and *3.* the presence of pain, tenderness and exudate. Inquiries are also made concerning possible previous treatment. This is a rather important question, since certain treatments, particularly of the home and self-administered variety, sometimes aggravate the condition and completely alter the picture.

Smears and cultures are made in all cases, but the physician who sees large numbers of these patients usually becomes so familiar with the manifestations of aural inflammation that he is able to institute treatment without waiting for laboratory reports. Diagnosis on the gross evidence is usually correct. If treatment by some one of the acceptable forms of

medical treatment does not produce improvement within 24 hours or thereabouts, it may be assumed that the causative organism has been incorrectly diagnosed. Treatment is therefore directed toward the predominant organism evident on the culture.

In my own cases the most frequent bacteria isolated have been pseudomonas and staphylococcus, and the most common fungi, aspergillus niger, aspergillus fumigatus and candida albicans. It is well known that most organisms isolated from infected ears are also natural inhabitants of ears free from disease. The wet exudate in a canal which is the site of infection is, however, made up of epithelial cells, cerumen and transudate, and these, in combination, make an excellent culture medium upon which bacteria may grow.[6,7]

An important consideration in fungous infections is the fact that a secondary bacterial infection may completely overshadow an initial fungous infection. The occasional patient seen with a perforated eardrum in association with inflammatory disease of the ear usually has this sort of condition. The most reasonable course of events is an initial perforation followed by a secondary fungous infection, with later extension to the middle ear.

Irradiation in the 182 cases which make up this series was applied by Dr. Dorothy Mattingly, who used two techniques. In the first 122 cases each treatment consisted of the application of 42 to 62 r., using 90 KV, 5 MA, and no added filtration. In the other 60 cases each treatment consisted of 100 to 150 r., using 100 KV, 5 MA, 1 mm. aluminum filtration, and a half-value layer of aluminum. Round treatment cones were used for both groups. The cone in the early cases was 5 cm. in diameter and was used at 22 cm. target skin distance. The cone for the later cases was 3 to 5 cm. in diameter and was used at 15.5 cm. target skin distance.

Only a few data need be mentioned in addition to those set forth in Table 1:

Otitis Externa: Eleven of the 28 cases of acute otitis ex-

terna of bacterial origin were bilateral. Fifteen of the 28 patients were treated with the smaller doses of Roentgen rays (62 r.) and the remainder with larger doses, most of which were 150 r. doses. Seventeen patients were completely relieved of pain by a single treatment, and in all but two of the remaining cases relief was secured with the second treatment.

Seven of the 13 chronic cases of otitis externa of bacterial origin were bilateral. The duration ranged from a year or less in six cases to 13 years in one case. Five patients were treated with smaller doses and the remainder with doses ranging from 100 to 150 r. Five patients were completely relieved by the first treatment, but three required three or four treatments for complete relief. The more frequent treatments necessary in this and other varieties of chronic disease are in line with all experience in the management of chronic aural inflammations. Three patients in the chronic group are known to have had recurrences of otitis during the period covered by this study.

Two of the seven acute cases of otitis externa of fungous origin were bilateral, as were nine of the 11 chronic cases. Five patients in the acute group were given smaller doses of X-ray. No patient required more than two treatments for complete relief of pain and most were relieved with a single treatment. Nine of the 11 patients with chronic disease were treated with smaller doses. Eight of the 11 required more than one treatment for complete relief, but only two required more than three.

One patient with bilateral otitis externa of fungous origin failed to respond to treatment. He received five applications of Roentgen ray over a nine-month period, in addition to treatment by the usual measures. He was extremely uncooperative, however, and as soon as pain was relieved he disappeared until recurrence of symptoms forced him to return for further treatment.

Furunculosis: Twelve of the 66 acute cases of furunculosis of the external ear were bilateral, as were 11 of the 28 chronic cases. Twelve patients in the acute group and the same num-

ber in the chronic group received larger doses of X-ray. Only three of the patients with acute disease required more than one treatment for complete relief of pain, but most of the patients in the chronic group required two or three treatments, and one patient required five.

There was one considerably delayed response in the acute group: The patient, a 16-year-old girl, received three Roentgen ray treatments and seven medical treatments before her furunculosis cleared. In the chronic group two patients are known to have had recurrences. Both had bilateral disease, which in one case had lasted for three years and in the other for an indefinite number of years.

Otitis Media: As the pain-relieving value of Roentgen ray therapy in diseases of the external ear became apparent, its use was extended to patients with otitis media. Two of the 15 patients in this series with acute middle ear disease had bilateral involvement. Six were treated with doses of 62 r. and the remainder with 150 r. One patient required four treatments for complete relief of pain, but the others were completely relieved with a single treatment. Two of the 13 patients with chronic otitis media had bilateral disease. Ten were treated with doses of 62 r. and three with doses of 150 r. As a rule, more than one treatment was required for complete relief of pain, but no patient required more than three.

It should be emphasized again that the use of Roentgen ray therapy in otitis media was entirely for the relief of pain. The usual therapeutic measures were used in addition, according to the indications of the special case.

CASE REPORTS.

The abbreviated histories which follow represent run-of-the-mill cases in which this method was used.

Case 1: A 12-year-old boy complained of pain in the right ear for four days, without discharge or fever. Examination revealed typical furunculosis; the external canal was inflamed and greatly swollen. Pain was completely relieved by a single application of Roentgen rays (63 r.) and the condition cleared completely after two office treatments. Three years later, similar involvement of the other ear cleared up after a single

office treatment; pain was slight and Roentgen ray therapy was not regarded as indicated.

Case 2: An eight-year-old boy was seen with extensive furunculosis of the right ear 48 hours after the onset of pain and fever to 103° F. Inflammation had been present for the previous 10 days and there had been no relief from standard measures employed by another otolaryngologist. The condition was completely relieved after a single application of Roentgen rays (62 r.) and two office treatments.

Case 3: A 56-year-old woman was found on examination to have external otitis of bacterial (staphylococcic) origin, which had been present for a week. Pain had been severe for 48 hours and local therapy was impossible. Discomfort was completely relieved by a single application of Roentgen rays (62 r.) and the condition was cleared up by one office treatment.

Case 4: A 42-year-old woman had had itching and intermittent pain in the right ear for four months, as the result of otitis externa of bacterial origin. Pain had been severe for several days. Attempts to use local therapy were unsuccessful because of discomfort, and four days after the patient was first seen Roentgen ray therapy (62 r.) was applied. The patient was somewhat relieved after the first treatment, but complete relief did not follow until four applications (a total dosage of 248 r.) had been made over an 18-day period. Local measures could be employed, however, after the first treatment, and office treatments were concluded within a week after the last Roentgen ray application.

Case 5: A 39-year-old man had suffered for a month with pain in both ears, associated with discharge from both ears and fever to 101° F., as the result of otitis externa of fungous origin. Pain was completely relieved after two applications of Roentgen ray (62 r. per treatment) three days apart. The condition apparently subsided completely under subsequent medical treatment but flared up a month later. Repetition of the previous regimen controlled both pain and inflammation. A mild recurrence in the left ear seven months later responded promptly to medical measures and the patient has remained well in the two years which have since elapsed.

Case 6: An 18-year-old girl had suffered from fever and pain in the left ear for six days; the ear had drained for the past three days. The appearance of the excoriated and swollen external canal was typical of otitis externa of fungous origin; the diagnosis was later confirmed in the laboratory. A single application of Roentgen rays (62 r.) completely relieved the pain, and three office treatments over a six-day period produced complete disappearance of the inflammation.

Case 7: A 25-year-old woman presented a chronic draining otitis media of the left ear, with excoriation of the external canal, which had been present for several months. Pain was severe. Three applications of Roentgen rays (two of 63 r. and one of 100 r.) at weekly intervals completely controlled the pain and so reduced the swelling that local treatment was possible. The patient did not respond to local measures, however, and radical mastoidectomy was eventually performed.

Case 8: A nine-year-old boy had had a painful, discharging left ear, not associated with fever, for two months. Pain was completely controlled by a single application of Roentgen rays (62 r.) and local measures, which had previously been unsatisfactory because of pain on manipulation, were applied successfully over the next two weeks. There has been no recurrence in the 18 months which have elapsed since the last treatment.

SUMMARY AND CONCLUSIONS.

During the past four years 182 patients with various inflammations of the ear (including 28 patients with otitis media) have been treated by the usual cleansing and medicinal measures, plus the application of Roentgen ray therapy for the relief of pain. This objective was usually achieved with one treatment in acute cases and with three treatments in chronic cases. While Roentgen rays were not applied with primary therapeutic intent, the prompt relief of pain permitted prompt and thorough cleansing of the canal and also permitted local applications to reach the affected areas promptly.

The application of Roentgen rays for the relief of pain in inflammation has a rational basis and the method is recommended as a useful adjunct to other therapy in these troublesome and sometimes disabling aural diseases.

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SUBGLOTTIC CYLINDROMA: WITH SPECIAL REFERENCE TO ITS CLINICAL COURSE.

DAVID IDE, M.D., and HERBERT L. CAHN, M.D.,
New York, N. Y.

Chevalier Jackson has stated that everything that wheezes is not asthma. This axiom is worth repeating and emphasizing. Tracheal obstruction causes a clinicopathological syndrome which so closely resembles true asthma that every case of clinical asthma should be studied for tracheobronchial pathology. In our case reported here we find a tumor in the subglottic region which acts and resembles the dynamics of asthma. It is of ball-valve obstruction, which on one hand permits air to enter the tracheobronchial tree and, on the other, prohibits its exit. Soon the lung alveoli become distended, so that exertion dyspnea is further aggravated. Since this growth may be slow in development, the patient may go on for several years before a complete asthmatic crisis occurs. X-ray studies and physical examination cannot and do not always aid one in ruling out pathology in the trachea. For many years endoscopy has been advised for all asthmatic cases for two reasons: first, to look for pathology and, second, for the possible application of newer methods in the treatment of this disease. There is no other ailment known to medicine which so entirely disrupts the usefulness of one's occupation as asthma; so, should one of the causes be eradicated, a person is immediately replaced in his useful occupation.

INCIDENCE.

Primary malignant disease of the trachea is not frequent and is a matter not considered in detail when malignancy is discussed. It is for this reason that the case reported is of utmost importance. It is the rarity and not the frequency

*Read before the Alumni Society of Lebanon Hospital, November, 1947.
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which has prompted the publishing of this most interesting case.

In a series of 27 cases seen at the Mayo Clinic since 1921, Tinney, Moersch and McDonald[1] concluded that although the

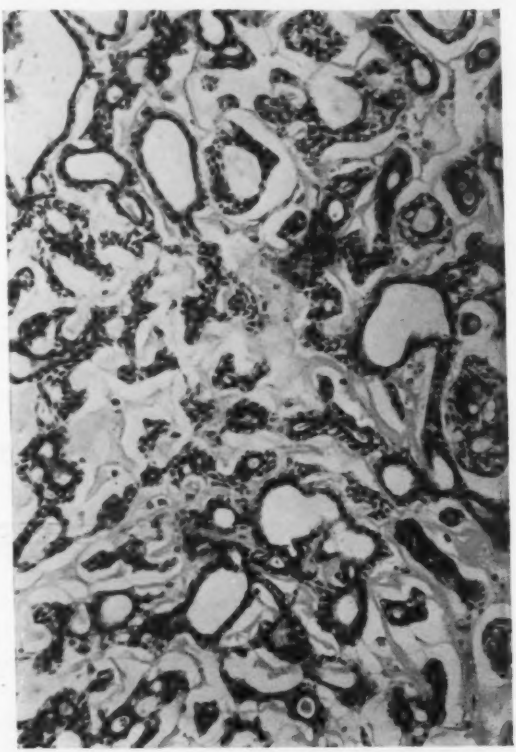

Fig. 1. Low power view of typical area of tumor showing nests of epithelial cells, many of which enclose spaces, loose fibrillar stroma with edema. In some areas these spaces contain plugs of secretion.

incidence of bronchogenic carcinoma has increased in the past decade, no corresponding increase has occurred in tumors of the trachea. In this series the upper third of the trachea

was involved in only 8 per cent of the cases and the lower third in 56 per cent. The posterior and lateral walls were more often involved than the anterior wall and cylindroma

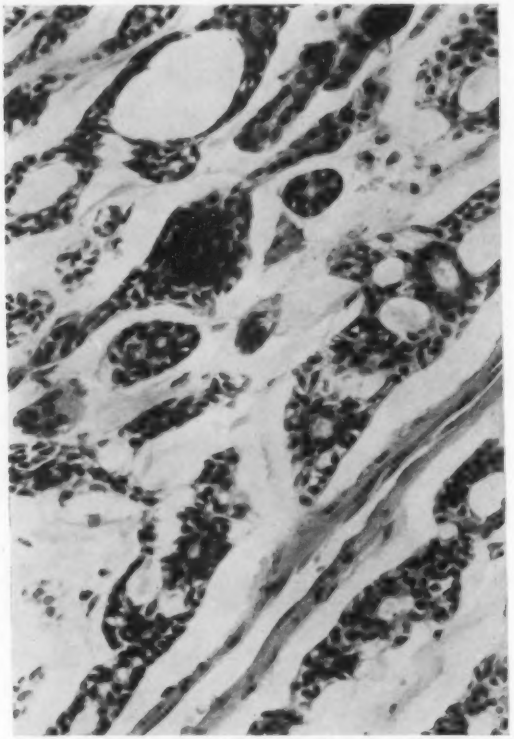

Fig. 2. Higher magnification shows details of cell structure.

was commonest in the upper one-third, while squamous cell and adenocarcinoma occurred in the lower one-third of the trachea.

Simpson and Moore[2] were able to find but 27 cases, which included one of their own, in their extensive review of the

literature on the subject. In but 20 of the reported cases were the histologic descriptions of the neoplasms sufficiently clear as to permit of accurate classification. Eleven of the series were glandular in type, cylindrical cell or adenocarcinoma. The high incidence of this type of malignant growth can be anticipated in view of the histologic structure of the tracheal mucosa with its stratified columnar epithelium and the profusion of mucus glands found within it. Eight of the series were typical squamous cell carcinomata. The origin of the squamous cells is more difficult to explain, but they apparently arise from the submucous glands or the cylindrical cells of the tracheal mucosa. Metaplasia may be the answer to this perplexing situation, but the type of growth may arise from cell nests of the primary embryonic epithelium of the primitive foregut from which the respiratory system develops.

Ewing[3] describes a cylindroma as a tumor, the stroma of which appears to form elongated twisted cords of hyaline material. He considered the tumor to be a basal cell carcinoma.

Denker and Kahler[4] considered the histogenesis to be an unsettled problem but favored the epithelial origin of the tumors.

Kaufman[5] concluded that they must be looked upon as epithelial tumors, and classified them as cylindromatous epithelial carcinoma.

Eigler[6] reviewed the rare tumors of the upper air passages including endotheliomas, peritheliomas and cylindroma. He reported four cases of cylindromas which represented a similar histological picture, in that they were made up of epithelial cords in a plexiform arrangement. The distribution of these tumors was as follows: in two cases on the palate, one in the larynx and one at the base of the tongue.

Guttman[7] reports an adult half-breed Indian female who, decidedly dyspneic, had a pronounced crowing inspiratory stridor. She had contracted what was diagnosed as asthma

about a year prior to his examination. At operation, a tumor was found which was reported as a cylindroma.

PATHOLOGY.

Cylindromata,[8] or tumors in which hyaline strands or balls are interspersed with strands of flattened cells, were first described by Billroth, and have been much discussed in later years. They are usually tumors which occur in the mouth, near the salivary glands, or in the nasal sinuses, but they may be found elsewhere. They are generally benign, but may metastasize. Histologically, the cylindrical hyaline structures, which are not peculiar to these tumors, but may occur in sarcomata and carcinomata, are seen to be formed by modifications of the connective tissue stroma or of the walls of the blood vessels, although in some cases such hyaline masses appear to be formed in the middle of a strand of tumor cells. The name is given on account of this anatomical peculiarity, and should not distinguish a special type of tumor. While it is difficult to decide upon the actual origin of the tumor cell, Ribbert has brought strong evidence that they are epithelial and that they arise from the glands or surface epithelium of the mouth and nasopharynx.

History and Physical: S. S., aged 52, white male, furrier, first admission to Lebanon Hospital on Dec. 4, 1946. The chief complaints were: choking sensation with some bloody expectoration, dyspnea and dysphagia.

In August, 1945, the patient consulted his doctor, complaining of a choking sensation. He was diagnosed as having asthma. He expectorated foamy mucus, had dyspnea and complained of feeling tired. There was no fever at any time. He lost 30 pounds during four months and began to have some difficulty in swallowing. Blood appeared in his sputum three weeks prior to admission and lasted for two weeks. Since August, 1945, he has had pain and discomfort in his throat almost continually. The asthmatic wheeze occurred intermittently and has been progressively worse. Appetite has been poor during the past year. Frequency of micturition, 15 to 20 times daily. Previous history: cystoscopy, six years ago for this complaint.

Physical Examination: An adult male patient in great respiratory distress, with a wheezing respiration but in no apparent pain. All the accessory respiratory muscles were violently in action. There was dullness to percussion of the left upper lobe anteriorly and posteriorly. On auscultation, wheezing sounds were heard throughout both lung fields except for an area of diminished breath sounds in the left upper lobe.

Heart: marked enlargement to the right. Blood pressure: 160 systolic, 80 diastolic.

Local examination: pharynx somewhat injected; no other abnormalities.

An indirect laryngoscopic examination revealed a small mass in the subglottic region on the right side. A direct laryngoscopic examination was then performed to obtain biopsy material for pathological diagnosis. Under local anesthesia, with 10 per cent cocaine HCL., an anterior commissure laryngoscope was passed, and a large mass about the size of a small grape was found in the region of the subglottic space, attached to the posterior wall of the larynx. The mass was then punched out in sections. Minimal bleeding occurred.

Pathological Report: Tissue was white-gray in color and of a rubbery consistency. Section reveals mucosa of the larynx, cartilage, mucous glands, voluntary muscle, and some inflammatory changes. The inflammation takes the form of a diffuse interstitial process in the submucosal tissue with isolation and suppuration of the muscle bundles. Numerous polynuclear leucocytes and some eosinophiles were present. There was no evidence in the section of a neoplasm.

Pathological Diagnosis: Tissue from the wall of the larynx showing inflammation.

Laboratory Report: Hemoglobin, 15:6 gm.; White blood count, 11,950; differential — polymorphonuclear leucocytes, 74 per cent; lymphocytes, 20 per cent, and band cells, 6 per cent. Wassermann was negative.

Progress: The patient felt somewhat better following the laryngoscopy. In fact, he felt so well that he refused to return for complete removal of the mass. His breathing improved, dyspnea subsided and he was able to walk freely.

On June 6, 1947, there was recurrence of symptoms with difficulty in swallowing food and a loss of several pounds in weight.

Physical examination showed the patient to have some difficulty in breathing, but no distress, and no cyanosis. Lungs showed diminished breath sounds and scattered rhonchi over both lung fields. Thyroid gland appeared symmetrically enlarged. The picture at this time was a counterpart of that at his first admission, but because of the recurrence of the symptoms the mental status was at a lower ebb. Preoperative sedation consisting of 1.5 gr. of luminal was given.

Operation: Under procaine 1 per cent infiltration anesthesia, an incision extending from the notch of the thyroid cartilage to the manubrium sterni was made. The ribbon muscles and the platysma were separated and the trachea exposed. A good deal of discomfort occurred at this point, so that a hurried tracheotomy had to be performed. The trachea was packed off above the tracheotomy tube. An incision was made in the thyrohyoid membrane and the thyroid cartilage incised in the midline. The alae of the thyroid cartilage were retracted. A gray-reddish mass about the size of a grape was seen attached to the posterior wall of the larynx just below the vocal cords. This mass was easily removed, since it was pedunculated. There was minimal bleeding. The area to which the tumor mass was attached was then fulgurated. Suction maintained a clear field at all times. The thyroid cartilages and ribbon muscles were replaced. A small amount of sulfadiazine powder was poured into the wound. The skin was closed, and a small Penrose drain was placed in the lower angle.

Pathological Report by the Pathologist, Dr. Joseph C. Ehrlich: Gross description: Received a mass of tissue approximately the size of a hazel nut. It is white in color and firm in consistency. On section, the appear-

ance is homogeneous, except for a small area of hemorrhage. Representative sections taken for microscopic examination.

Microscopic Findings: Section revealed a neoplasm whose pattern is quite uniform. It is covered on one side by laryngeal mucosa and is composed of nests of small, dark, polygonal cells. In the center of many of these nests there is a space which sometimes contains mucus or serous material. The cytoplasm of many of the cells has a vacuolated, hydropic appearance. The stroma consists of thin, collagen strands often associated with edema and hyaline change. There are a few areas of hemorrhage present. The histologic pattern is characteristic of cylindroma.

Diagnosis: Cylindroma.

Subsequent Course: The patient was placed on fluids by mouth. Penicillin, 100,000 units, was given hypodermically every three hours for 48 hours. There was no rise of temperature at any time. On the second day the patient was out of bed. On the third day the tracheotomy tube was removed, and patient was discharged from the hospital on the fourth day.

Two weeks after the operation the patient could not be restrained from returning to work. He had gained 40 pounds, had none of the symptoms he suffered prior to the operation. He walked stairs and distance without any effort and really did a hard day's work.

COMMENT.

A word about what should one do should a biopsy report be cylindroma. According to Beck and Guttman[9] cylindromas are characterized by "slow growth, local progression, lack of metastasis, prompt regression to irradiation and recurrence after local excision." Lemaitre[10] definitely concluded in his studies that these tumors are not readily sensitive and, therefore, treatment should be surgical. With diversity of opinion as to the pathological nature of these tumors, no unequivocal method of treatment can be advised — surgery with fulguration or radiotherapy? In this case surgery so far has proven a safe and remedial procedure.

SUMMARY.

1. A case of a subglottic tumor treated as asthma for two years.
2. Biopsy first showed chronic inflammation, proving inadequacy of one biopsy.
3. Ball-valve action of this tracheal tumor.
4. Surgical removal with fulguration of the base.

5. Complete freedom from symptoms and no recurrence.

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AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

The Home Study Courses sponsored by the American Academy of Ophthalmology and Otolaryngology, in the basic sciences related to these two specialties, will be given again, beginning Sept. 1, 1948. Registrations must be completed before Aug. 15. Detailed information may be secured from Dr. William L. Benedict, Executive Secretary, 100 First Avenue Building, Rochester, Minn.

PROPYLENE GLYCOL AS A MENSTRUUM FOR SULFATHIAZOLE WITH PRACTICAL APPLICATION TO OTOLARYNGOLOGY (SECONDARY REPORT).

ROGER W. BLACKFORD, M.D.,
Indianapolis, Ind.

In March, 1943, Blackford[1] made a preliminary report on the use of propylene glycol as a menstruum for sulfathiazole with practical application to otolaryngology and oral surgery. The purpose of this paper is to present additional evidence obtained over a two-year period that a 3 per cent solution of sulfathiazole in 100 per cent propylene glycol is nonirritating and nontoxic; that it is valuable in controlling secondary infection; that it can be used generally in large quantities without untoward results; and finally, that clinically there is no evidence of impairment of ciliary action.

The types of cases used in this report differ widely from those of the preliminary report, in that they are primarily postoperative cases. The postoperative group includes: *1.* radical external frontal (Killian); *2.* submucous resection; *3.* mastoidectomy (cortical and radical); *4.* submucous resection, biliateral ethmoidectomy, bilateral sphenoidectomy, and bilateral Caldwell-Luc; and *5.* cases in which one or more of the paraansal sinuses required a surgical attack. Other types of cases in which this preparation was used include: *1.* nasal vestibulitis; *2.* Vincent's infection of the tonsil; *3.* chronic eczema of the external auditory canal; *4.* mycotic infections in the external auditory canal; and *5.* furunculosis of the external auditory canal.

GENERAL DISCUSSION.

The postoperative cases selected at random totaled 202, and of these, 108 were used as control cases. The total includes

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two cases in which a radical external frontal sinus operation was performed; however, the preparation was used to saturate the drainage wick on one case only. When a Caldwell-Luc was performed or when it was necessary to do a window operation, 5 cc. of the preparation were instilled into the maxillary sinus following the routine postoperative irrigation. In all other sinus operations the writer placed cotton tampons saturated with the preparation in each side of the nose and left them in place for 10 to 15 minutes. When used in cases in which either a cortical or a radical mastoid operation had been done, the drainage wicks were simply saturated with the preparation.

Interestingly enough, the most spectacular results obtained by the use of sulfathiazole in propylene glycol were observed in cases following mastoidectomy. In the cases in which unsatisfactory healing was present before the use of the preparation, the writer found that unhealthy granulation tissue, sequestration, acute upper respiratory infections and the ill effects of prolonged treatment by chemotherapy were the most common etiological factors. The writer has recently seen a case in which there was complete destruction of the entire squamosa complicating an acute suppurative mastoiditis which required a very extensive operative attack. A 3 per cent solution of sulfathiazole in propylene glycol was used generously. The result was rapid and complete healing of the large area.

Generally speaking, the writer found that in the nasal cases in which the preparation was used there was less tendency toward the formation of crusts. In every case there was a cleaner postoperative field. In all cases requiring an extensive operative attack on one or more of the paranasal sinuses, the recovery period was definitely shortened through the application of this preparation.

In the group in which no operation had been performed, the most striking results were observed in the cases of nasal vestibulitis. Relief from soreness and severe pain was, in many cases, almost instantaneous. In almost all cases complete recovery was observed in from three to five days. Topical

application in Vincent's infection of the tonsil proved valuable in controlling secondary infection and shortened the recovery period. In cases of chronic eczema of the external auditory canal, mycotic infections of the ear and furunculosis of the external auditory canal, the preparation was of no value.

CONCLUSIONS.

1. A 3 per cent solution of sulfathiazole in propylene glycol used locally is nonirritating and nontoxic.
2. In this series of cases the writer has seen no untoward effects.
3. The preparation proved valuable in controlling secondary infection.
4. The recovery time was definitely shortened in all cases requiring an extensive operative attack on the paranasal sinuses.
5. The preparation is of special value in the postoperative mastoid cases where normal healing is delayed.
6. There is no doubt that penicillin has taken the place, in some conditions, that sulfathiazole in propylene glycol filled. There are, however, certain lesions in which nothing gives the therapeutic value of this preparation.

REFERENCE.

1. BLACKFORD, ROGER W.: Propylene Glycol as a Menstruum for Sulfathiazole with Practical Application to Otolaryngology and Oral Surgery (Preliminary Report). THE LARYNGOSCOPE, LIII:164, Mar., 1943.

A SAFE AND EFFICIENT CLEANSING DEVICE FOR THE NASOPHARYNGEAL RADIUM APPLICATOR.*

SAMUEL L. FOX, M.D., and G. BROOKS WEST, JR., M.D.,
Baltimore, Md.

For several years the authors have been treating nasopharyngeal lymphoid tissue by the use of the nasopharyngeal radium applicator supplied by the Radium Chemical Co. We have been confronted with the problem of some safe and efficient means of cleansing the applicator following its use.

A cylindrical receptacle of chrome-plated brass, 17 cm. high, with an outside diameter of 4 cm., and walls 3.5 mm. thick, has been devised for this purpose. A cap of similar material fits over the cylinder and this may be easily removed for cleansing or refilling the receptacle. An opening 13 mm. in diameter is present in the cap to permit insertion of the applicator. The cylinder is mounted on a wide, heavy base so that overturning is virtually impossible (see Fig. 1). Contained in the receptacle are numerous radially arranged bristles which run the entire height of the cylinder. (A properly fitting bottle brush serves admirably for this purpose.) A layer of absorbent cotton is placed in the base of the container so that damage to the radium capsule will not occur, should it strike the bottom of the container. The container is filled with a fresh solution containing 10 per cent "Caroid" powder† in 1:1,000 aqueous solution of Zephiran.‡

For cleansing after use, the applicator is held by its handle and is inserted through the opening in the top of the receptacle and pushed down through the bristles and solution. The applicator is moved up and down so as to loosen any adherent mucus and debris and is left in the solution for approximately

*From the Department of Otolaryngology of the South Baltimore General Hospital.

†Solutions of "Caroid" are unstable and should be replenished once weekly. The powder is supplied by the American Ferment Co.

‡Zephiran solutions are supplied by the Winthrop Chemical Co.

This device may now be obtained from Radium Chemical Co., Inc., 570 Lexington Avenue, New York 22, N. Y.

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one minute. The applicator is then replaced in a 2-inch lead block for storage.

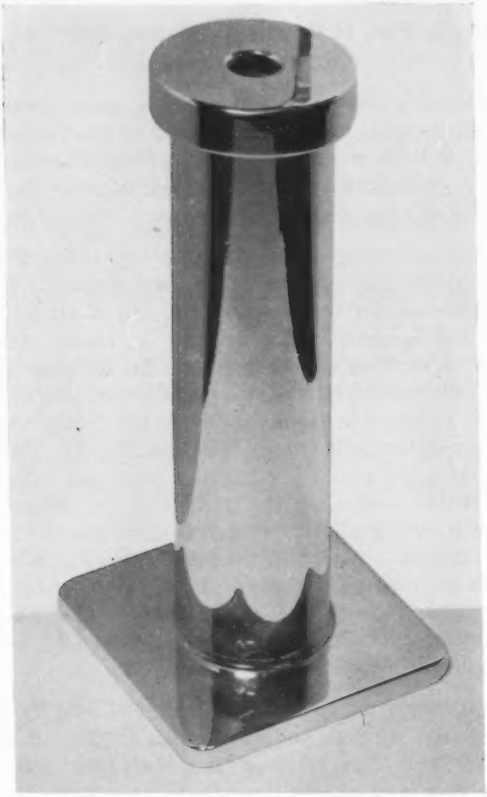

Fig. 1. Nasopharyngeal radium applicator cleansing device.

The thickness of the brass walls of the container affords adequate protection against the beta rays of the applicator during cleansing. The bristles catch the particles of mucus and debris as the applicator is inserted into the receptacle, while the "Caroid" acts as a protein digestant. The aqueous Zephiran solution subjects the applicator to antiseptic action.

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Manufacturer: Beltone Hearing Aid Co., 1450 W. 19th St., Chicago, Ill.

Electroear Model C.

Manufacturer: American Earphone Co., Inc., 10 East 43rd St., New York 17, N. Y.

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Manufacturer: Maico Co., Inc., North Third St., Minneapolis, Minn.

Mears Aurophone Model 98.

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Telex Model 22; Telex Model 612; Telex Model 900; Telex Model 1020; Telex Model 1550.

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Trimm Vacuum Tube No. 300.

Manufacturer: Trimm, Inc., 400 W. Lake St., Libertyville, Ill.

Unex Model "A."

Manufacturer: Nichols & Clark, Hathorne, Mass.

Vacolite Model D.

Manufacturer: Vacolite Co., 3003 N. Henderson, Dallas, Tex.

Vactuphone Hearing Aid.

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Zenith Radionic Model A-2-A; Zenith Radionic Model A-3-A; Zenith Radionic Model B-3-A; Zenith Model 75.

Manufacturer: Zenith Radio Corp., 6001 Dickens Ave., Chicago, Ill.

AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION.

The Twenty-ninth Annual Meeting of the American Broncho-Esophagological Association was held in Atlantic City at the Chalfonte-Haddon Hall on the afternoons of April 7 and 8, 1948. The program follows:

Bronchial Adenomas—Dr. Louis H. Clerf, Philadelphia, Pa.

Fibrocystic Disease of the Pancreas, and Its Relation to Pulmonary Suppuration—Dr. Joseph P. Atkins, Philadelphia, Pa.

Bronchoscopic Examinations in the Newborn — Dr. Clyde Heatly, Rochester, N. Y.

Tracheal and Bronchial Obstruction Due to Cardiovascular Anomalies—Dr. Paul H. Holinger, Chicago, Ill.

Bronchospirography—Dr. Charles Norris, Philadelphia, Pa.

Histal Hernia of the Esophagus—Dr. F. Johnson Putney, Philadelphia, Pa.

Syphilitic Tumor of the Bronchus—Dr. Archibald R. Judd, Hamberg, Pa.

The Present Status of Broncho-Esophagology in Latin America—Dr. C. L. Jackson, Philadelphia, Pa.

Reconstruction Surgery of the Trachea—Dr. Longmire, Baltimore, Md.

Streptomycin Therapy in Tracheal and Bronchial Tuberculosis—Dr. John J. O'Keefe, Philadelphia, Pa.

Rhinoscleroma of the Bronchus—Dr. Ricardo Tapia, Mexico City, Mexico.

Allergic Manifestations of Pulmonary Disease—Dr. Francis W. Davison, Geisinger Memorial Hospital, Danville, Pa.

Hemoptysis Due to Chronic Mediastinal Venous Obstruction—Dr. Stanton A. Friedberg, Chicago, Ill.

Granuloma of the Larynx Due to Intratracheal Anesthesia—Dr. Frederick T. Hill, Waterville, Me.

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AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY.

Chairman: Dr. Fletcher D. Woodward, 104 E. Market St., Charlottesville, Va.
Secretary: Dr. James M. Robb, 641 David Whitney Bldg., Detroit, Mich.
Meeting: Chicago, Ill., June 21-25, 1948.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

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Executive Secretary: Dr. William L. Benedict, Mayo Clinic, Rochester, Minn.
Meeting: Chicago, Ill., Palmer House, Oct. 10-15, 1948.

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President: Dr. W. Byron Black, 530 Professional Bldg., Kansas City, Mo.
Secretary-Treasurer: Dr. Francis L. McGannon, 14900 Detroit Ave., Lakewood, Ohio.
Meeting: Chicago, Ill., Palmer House, Oct. 8-9, 1948.

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